

# *LLNL Report*

USNDP

November 2012

Neil Summers



LLNL-PRES-599512

This work was performed under the auspices of the U.S. Department of Energy by Lawrence Livermore National Laboratory under contract DE-AC52-07NA27344. Lawrence Livermore National Security, LLC



# LLNL Personnel

- \$144k FY12 funding
- \$61k FY11 carry over
- \$157k FY12 total costs
- \$48k rollover into FY13

Funding	FTE	Temporary	Heads
USNDP	0.4		5
ARRA	0.31	0.68	3
Other	5.5		10
Total	6.21	0.68	11

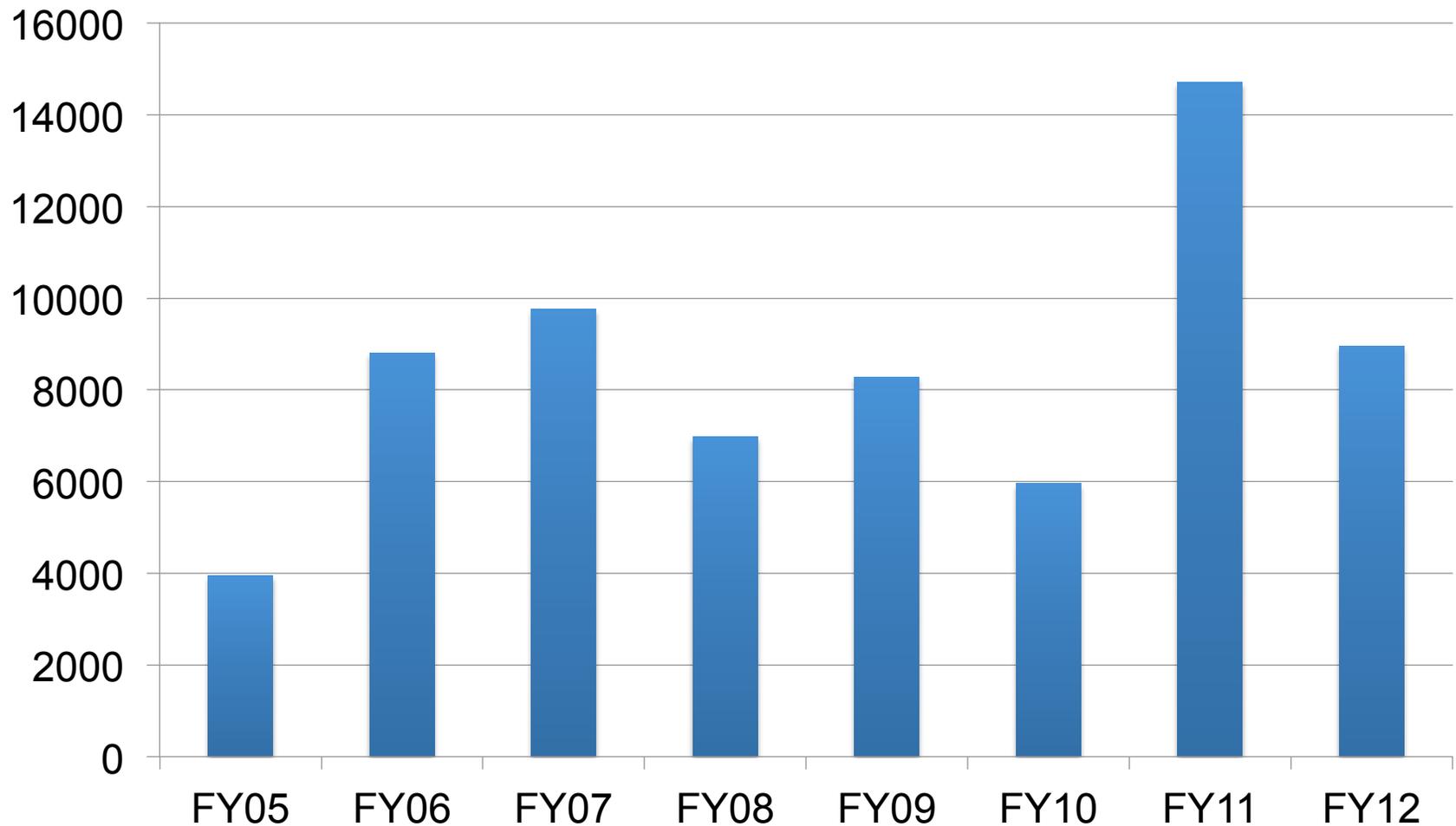
# Task Force on Nuclear Data Needs for Homeland Security

- Chair the Task Force on Nuclear Data Needs for Homeland Security of the CSEWG
- Started with report by Dennis McNabb in 2005
- Dave Brown continued with task while at LLNL
- Dave Brown moves to BNL
  - Has chair been taken with him to BNL?
    - Dave Brown appears on website as chair
  - Brad Sleaford asked to give talk this year?
  - Unclear in report who now has this responsibility

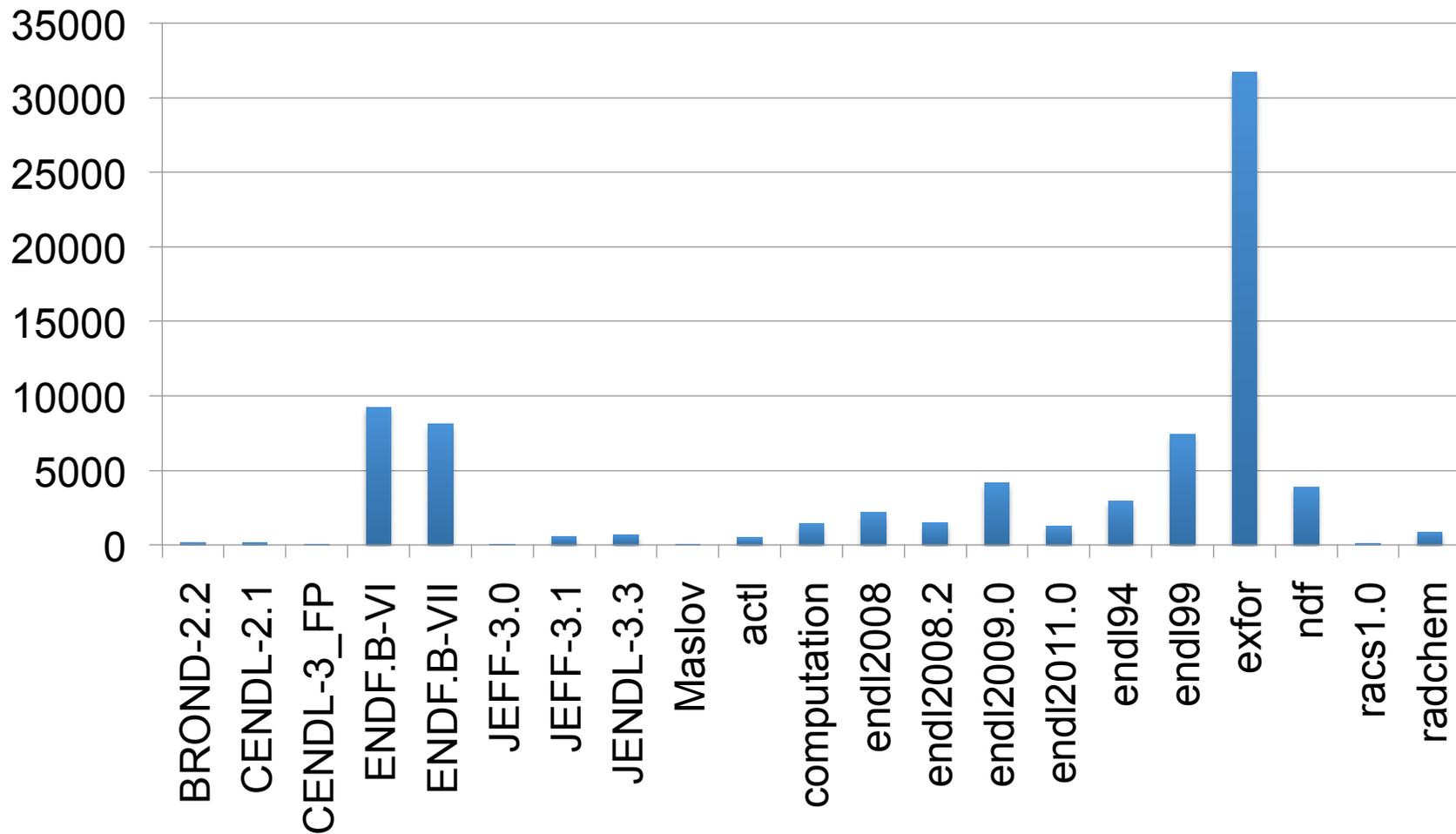
# Data Dissemination

- <http://nuclear.llnl.gov>
- Nuclear and Atomic Data Viewer
  - Disseminates nuclear data to users at LLNL
    - 8958 requests FY12
- Website used to post GND source code and example GND files
  - Points to files on GForge server at NNDC
    - v1.0, released Nov 12 2011: 40 total downloads
    - v1.1, released May 24 2012: 39 total downloads

# Data Requests per FY



# Data Requests per Database



# Nuclear Reaction Physics

## ENDF Evaluations

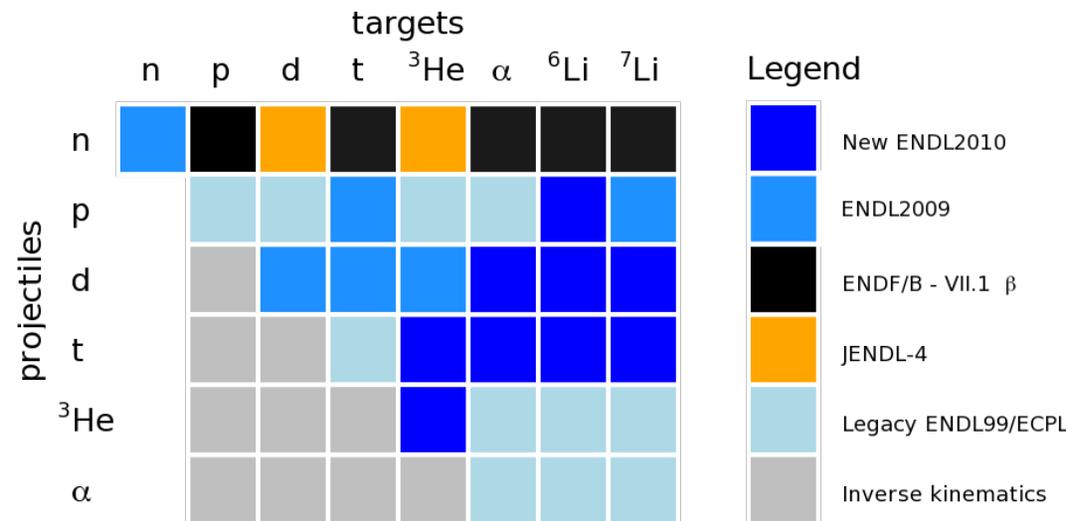
- Perform new evaluations as per LLNL customer requests and submit these and other LLNL generated evaluations into ENDF
- In collaboration with BNL, coordinate the development of the Generalized Nuclear Data (GND) format as a proposed successor format for ENDF
  - National Coordination Section?

# Nuclear Reaction Physics

## ENDF Evaluations

### Charged-Particle Evaluations

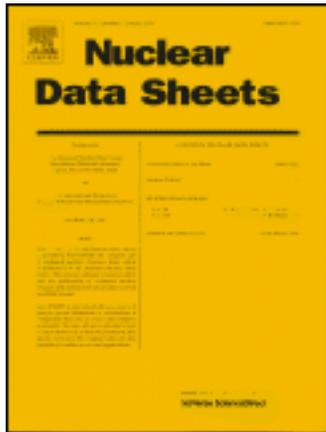
- Converting LLNL's charge particle evaluations for light-ion evaluations into ENDF format
- ENDF contains no  $\alpha$  incident evaluations and very few charge particle evals
- Several legacy ECPL evaluations
- Many new evaluations from LLNL (Petr Navratil)
- Others created using inverse kinematics
- Work started in FY12
- Will continue in FY13



# Nuclear Reaction Physics

## ENDF Evaluations

### Generalized Nuclear Data (GND)



### **Nuclear Data Sheets article on Generalized Nuclear Data to be published in Dec issue of NDS**

Generalized Nuclear Data: a New Structure (with Supporting Infrastructure) for  
Handling Nuclear Data

C.M. Mattoon\*, B.R. Beck, N.R. Patel, N.C. Summers, G. Hedstrom  
*Lawrence Livermore National Laboratory, 7000 East Avenue, Livermore CA, United States*

D.A. Brown  
*National Nuclear Data Center, Upton NY, United States*  
(Dated: May 22, 2012)

Information Dissemination, Publications Section?

# International Coordination

- Dennis McNabb proposed new WPEC subgroup to foster international collaboration on a new data format
- Working Party on International Nuclear Data Evaluation Co-operation (WPEC)
- WPEC Subgroup 38 has been approved
- 38 Beyond the ENDF format: A modern nuclear database structure
  - Coordinator: D. McNabb
  - Status: First meeting Nov 29-30, 2012

# Nuclear Model Development

- Event by event fission modeling (NA-22 project) [Ramona Vogt]
  - Improved photon emission in FREYA
  - Includes rotational energy of the fragments and emission of yrast photons
  - Paper submitted to Physical Review C
  - Incorporate FREYA into the MCNP transport code as a part of the LLNL fission library
- Reaction theory for surrogate reactions (ASC/PEM) [Jutta Escher]
  - Cross sections from surrogate reactions corrected for spin/parity distributions, i.e. beyond Weiskopf-Ewing approximation
    - $Y_{88}(n,2n)$
    - $Am_{241,242m}(n,f)$
- Optical Model
  - New actinide optical potential in progress
    - Fitting using converged coupled channels sets ( $s > 5$  for even-even)
    - Odd nuclei obtained from transformation of equivalent even-even
    - Fitting in progress

# Nuclear Structure Physics

## Neutron-Induced $\gamma$ -Ray Data Evaluation

- EGAF project funded by NA-22 at LLNL
  - Brad Sleaford, Neil Summers, Jutta Escher
- Assisting EGAF data evaluation in collaboration with LBNL
  - providing automated toolset for performing DICEBOX calculations of statistical gamma rays
- Produce new level schemes and thermal neutron capture cross sections
- LLNL working towards putting this data in ENDF evaluations

# Nuclear Data Measurements

- 2 measurements on Pu238 using the DANCE determine fission contribution as the background to (n,g)
- Surrogate cross section measurements completed for
  - Am240(n,f), Am241(n,f), Am242(n,f), Y88(n,2n)
  - Evaluations underway
- Experimental data has been taken and analysis underway for
  - Y87(n,g), Np239(n,f), Pu236(n,f), Pu237(n,f), U232(n,f), U233(n,f)
- New levels and gammas discovered in U237, U235
- Data taken on Yb isotopes to validate (p,d) reaction channel in preparation for Lu measurements in FY13.
- Data taken on Mo95(d,p) to benchmark surrogate technique in spherical region for (n,g) reactions.

# ARRA funding of GND

- ARRA funding of GND integration with ENDF format expires in FY13
- Propose increase in base USNDP funding in FY14 to continue LLNL involvement with developing next generation of data formats
- Continue to support efforts to release ENDF library in GND and to coordinate with CSEWG in its adoption
- Work with LBNL, BNL and others to expand new formats to nuclear structure data e.g. ENSDF, RIPL

# LLNL V&V

- LLNL's V&V efforts towards ENDF/B-VII.1 lacking
  - lack of resources
  - tools for processing ENDF for use in LLNL codes (Mercury/Amtran) still cumbersome
    - with GND and new tools this is improving
  - Difficulty in testing pure ENDF/B-VII.1 due to different data requirements
    - outgoing charge particle distributions
    - ENDL supplements data with other evaluations distributions
    - will improve as new evaluations more complete
- Automated test suite developed at LLNL
  - Need better integration with ENDF for next release

# Future efforts (ASC/PEM)

- ENDF Evaluations

- Leading effort with LANL for new Pu239(n,f) cross section based on TPC data
  - Initial efforts focusing on understand missing correlations between experimental data sets and their effect on uncertainties
- Collaborating with LANL on new Prompt Fission Neutron Spectrum for Pu239 for upcoming Chi-Nu data
- Joint effort towards new evaluation of Pu239